APPENDIX 2. On rediscovering some of Japan's historical & heritage earthworm types (with confirmed *Eisenia japonica* record in Japan from 1876; also an earlier *Amynthas vittatus* or "*Metaphire levis*" USA record here corrected as *A. tokioensis*).

By Dr R. J. Blakemore, Zama Japan (Feb., 2022).

Critically important historical specimens were thought lost for many decades (Figs. 14–15) and, because many earlier species were not yet resolved, prevented taxonomic progress for over a Century (Tabs. 3–6). That specimens were deliberately taken from institutions and hidden for 30 years without proper curation is a disservice to Science.

Now safely returned, states of all remaining specimens are preserved for perpetuity.

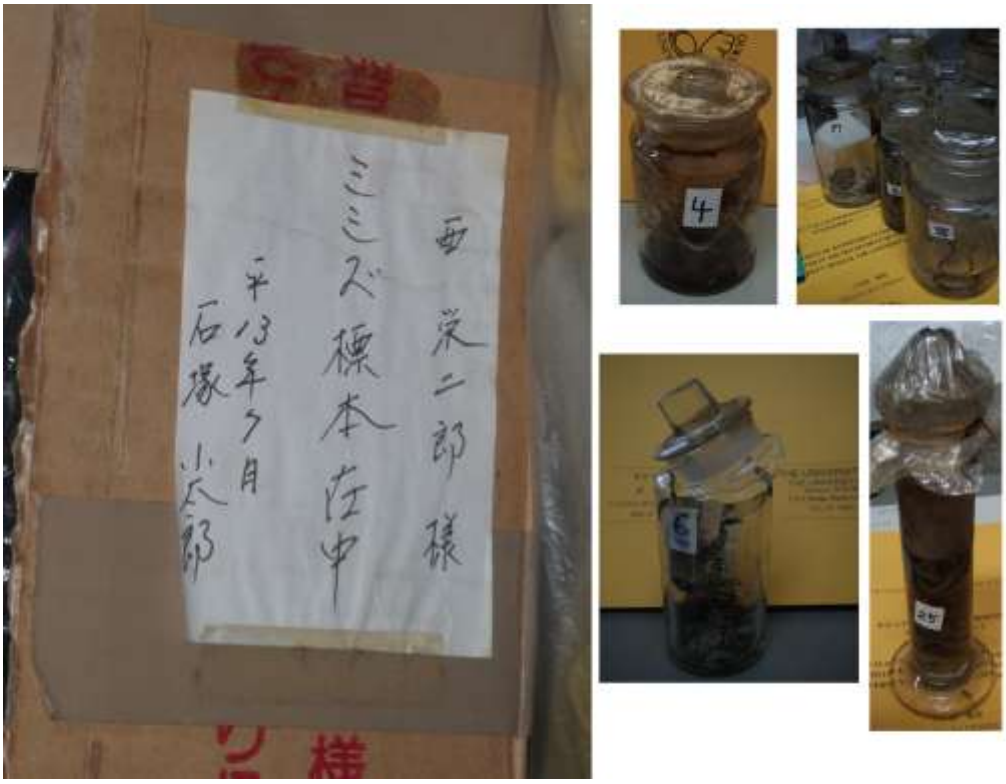

Figure 14. Box of historical Tokyo University (Todai) earthworms as rediscovered by RJB in 2010 (lost for 110 years with 30 years absence!) – labelled: "[To] *Dr Eijiro Nishi, Original earthworm samples, Heisei 13, 7 month* [July, 2001]. [From] *Mr Kotaro Ishizuka* (石塚小太郎)" with 40 heritage jars of Goto & Hatai's classical types, some broken or dried out as shown, for some reason secreted in a corner of a room at Dr. Eijiro Nishi's polychaete lab in Yokohama National University. When handed to Dr Nishi, without an inventory, they were falsely said to "*contain no type specimen*"!

These vitally important historical samples now stabilized and stored under UMUTZ curatorial care of Dr Rei Ueshima with summary data presented in Blakemore & Ueshima (2011). Although DNA sampling was attempted with many failures, no funding was available for completion of descriptions of these classical type materials.

Taxonomic summary and contents reports are in Tables 3–5.

Table 3. Goto & Hatai earthworm sample jars from Todai Museum found at Yokohama YNU (from author's preliminary report on discovery, October, 2010 summarily published by Blakemore & Ueshima, 2011 — http://umdb.um.u-tokyo.ac.jp/DDoubutu/pdf_mr/MR_090-02.pdf).

Jar / Nos.*	Labels (mostly Japanese)	Specimens	Condition	Type Status
Nil	"March, 1887" "Parasite (?) from the lung of a python."	Possibly a Pentastomida "tongue worm"	Good	?
1/Og-1	Nil	2 *Eisenia fetida*	Dried	Non types
2/Og-2	Nil	1 *Metaphire sieboldi*	Dissected but in fair state	Non type
3/Og-3	明治 42/4/2 [=1910] 沖縄農学校 Okinawa Agricultural College	Many *Amynthas* / *Metaphire* spp.	Good	Non types
4/Og-4	Illegible	Worms?	Poor	?
5	Partly illegible "..COMMUNIS"	Microdrile *Nais communis*	Fair	?
6/Og-6	明治 44/5/22 [=1911] 南牧？埔里社 Taiwan, Puli	~10 megadrile worms	Dried /moldy	Non types?
7/Og-7	明治 32/7/8 [=1899] 基陵石 Kiirun, Taiwan	Several *Amynthas* / *Metaphire* spp	Wet	Non types from Taiwan?
8/-Og-8	明治 32/7/27 [=1899] 恒春 Koushun, Taiwan	Several *Amynthas* / *Metaphire* spp	Dried	Non types from Taiwan?
9/-Og-9-1–3	明治 32/7/30 [=1899]. テラソ (Mtn.) Teraso, Taiwan	*Amynthas* / *Metaphire* ca. 3 spp.; *A.* cf. *catenus*; *A. corticis*	Good	Non types from Taiwan?
10/-Og-10-1/10-2)	: 明治 29/7/? [=1896] 大学構内 Tokyo University Campus (Komaba not Ueno?)	*Amynthas* / *Metaphire* spp.; *A. irregularis*; 6 specimens	Good	Non types?
11/ Og-11	"20012 *Nais proboscides* O.F. Müller Naidomorpha, Oligochaeta. Leipzig"	Microdrile *Nais proboscidea*	Good	Type on loan?
12/Og-12	明治 42/4/? [=1909] 沖縄首里 Okinawa Shuri	'Soup'	Poor	Non types
13/Og-13	明治 42/4/? [=1909]	*E. fetida* 5 specimens**	Fair,	Non types
14/ Og-14	明治 42/4/12 [=1909] 琉球奄美大島名瀬 Nase Ryukyu Amami (Okinawa)	*Amynthas* spp. ~10 specimens	Good	Non types
15/Og-15	Nil	Many	Fair	Non types?
16/Og-16	琉球？島砂地 Sunashima, Ryukyus?	Several megadriles	Dried	Non types?

17/Og-17	明治 36/9/9 [=1903] 厳原宮ノ上 Isuhara Miyanoue (Nagasaki)	*Metaphire sp.* 5 specimens	Fair	Non types
18/Og-18	No date 台湾宣蘭 Taiwan Lan Sun (Ilan Isl.)	*Metaphire sp.* one specimen	Large un-dissected	?
19/Og-19	明治 42/4/? [=1909] 琉球沖？山附近 (Ryukyus)	?	Poor	Non types
20/-Og-20	明治 36/9/29 [=1903] 藤原 Izuhara (Tsunashima, Nagasaki?)	*Amynthas* / *Metaphire* spp. many	Good	Non types
21/Og-21	明治 44/5/30 [1911] 台湾阿候乃東港街 Ako, Taiwan	*Amynthas* sp. one specimen	Good	Non type
22/-Og-22	明治 42/4/12 [1909] 琉球奄美大島名瀬山上 Amami Oshima, Mt Naze	*Metaphire* sp. one specimen	Good	Non type
23/Og-23	"*Perichaeta in copula* May 27 1903 Tokyo"	*Amynthas* sp. two specimens	Fair	Non types
24/Og-24	"*Allolobophora foetida* Loc. Kofu, Kai" (Yamanashi-ken)	*E. fetida* 2 specimens + 7 cocoons	Fair	Non types
25/Og-25-1/Og-25-2	Illegible	*Amynthas* / *Metaphire*, + *A. carnosus*	Fair, in formalin	Types?
26/Og-26	"201 ***Perichaeta communissima*** Oligochaeta, Chaetopoda Tokyo"	*M. communissima* two specimens	Good, one dissected	**SYNTYPES**
27/Og-27-1/Og-27-2	明治 33/6/9 [=1900] 鹿児島城山 Kagoshima Shiroyama (Kyushu)	*Metaphire sieboldi* + two *M. hilgendorfi*	Fair, un-dissected	Non types
28/Og-28	"南京中央科学？生物研究所 (China)..., Prof. C. Ping.. *Perichaeta hupeiensis* Mich (?) Goto Oct 1924"	*Amynthas hupeiensis* 10 specimens	Good	Non types
29/Og-29	明治 42/4/? [=April,1909] "琉球鹿児島県城山" [Ryukyu deer(?)] Shiroyama, Kagoshima	*Metaphire sieboldi* 6-7 specimens	Moist, good	Non types
30/Og-30	Nil	Many polychaetes, corals and oligochaetes	Mixed	Non types?
31/Og-31	Nil	*E. fetida*	Good	
32/Og-32	明治 42/4/2 [=1909] 琉球沖縄名護農学校内 (Nago, Okinawa)	*Amynthas* spp. some specimens	Fair	Non types
33/Og-33	"*Allolobophora foetida* Tokyo May 1st 190..."	*E. fetida***	Good	Non type

34/Og-34	"***P. levis*** Goto & Hatai. 明治 29/8/? [=1896]. [Location:] 熊本県菊池" (Kikkuchi, Kumamoto-ken)	*Amynthas levis* four specimens, one dissected	Good	**SYNTYPES**
35/Og-35	"6/91" [1891] "***Perichaeta micronaria*** Tokyo"	*Amynthas micronarius* two specimens	Poor, dried	**TOPOTYPES (SYNTYPES?)**
36/Og-36-1/Og-36-2	明治 29/8/? [=1896] "*Perichaeta micronaria* Meiji 29 [1896] August [Loc:] Tozaki, Kikkuchi, Kumamoto-ken. [Col:] Takiyama"	*Amynthas micronarius* + *A.* cf. *heteropodus* several specimens	Good	Non types? (Possibly, as this location not in original descriptions)
37/Og-37	1887-1889 "*Bipalium* .... Saikyo... Kikuchi Summer of 1887 – 1889 90% Alcohol"	Many earthworms and planarians	Dried	Non types?
38/Og-38	: 明治 42/4/5 [=1909] "琉球沖縄貝納" (Okinawa Island, Ryukyus)	Several unidentified megadriles	Fair	Non types
39/Og-39	明治 39/4/? [=1906] "*Eisenia sp.*" "東京小石川" - Tokyo Koishikawa (Todai Botanical Gardens?)	Many specimens of exotic *E. fetida***	Good	Non types**
(40?)/Og-40	Taisho (=>1912-1926) Akita-ken (in Japanese)	One *Amynthas* sp. specimen	Poor	Non type?

* Jar Nos. by Mr Kotaro Ishizuka / UMUTZ-Ann-Og Specimen Nos. newly registered.
** Note several early reports of occurrence ~1906 of exotic *Eisenia fetida* in Japan cf. Michaelsen's earlier <1892 record noted below (Tab. 4). Conversely, all that Minamiya (2021) can provide is: "*In the early Showa period* [1926–1989]*, it seems that it was widely sold as fishing bait under the name of "Tokyo earthworm", and it is reported that it was called in this way in Kanazawa and the Fuefuki River basin in Yamanashi prefecture (Shintani, 1929b; Oishi, 1931b). In the Fuefuki River basin in Yamanashi Prefecture, it was reported that there was an old man who said that in the 1920s, anglers from the city threw away the surplus earthworms and it became noticeable around 1930.*"

Tables 4–5 have earliest, mostly Japanese native and pheretimoid species reports although the first report of *E. fetida* from Japan dating to before 1876 is also noted.

Table 4. Original and current names of earliest Japanese megadrile species.

No.	Original name	Current combination/synonymy
1	*Megascolex sieboldi* Horst, 1883	*Metaphire sieboldi*
2	*Megascolex japonicus* Horst, 1883	*Amynthas japonicus**
3	*Megascolex schmardae* Horst, 1883	*Duplodicodrilus schmardae*
4	*Perichaeta ijimae* Rosa, 1891	*Amynthas corticis* (Kinberg, 1867)
5	*Allolobophora japonica* Michaelsen, 1892: 230**	*Eisenia japonica*
6	*Moniligaster japonicus* Michaelsen, 1892: 232**	*Drawida japonica*
7	*Pheretima hilgendorfi* Michaelsen, 1892: 236**	*Metaphire hilgendorfi*
8	*Ph. divergens* Michaelsen, 1892: 243**	?*Amynthas corticis* (Kinberg, 1867)

9	*Ph. rokugo* Beddard,1892: 756***	*Metaphire hilgendorfi*
10	*Ph. nipponica* Beddard, 1892: 760***	*Amynthas corticis* (Kinberg, 1867)
11	*Ph. masatakae* Beddard, 1892: 761***	*Amynthas masatakae*
12	*Ph. tokioënsis* Beddard,1892: 762***	*Amynthas tokioensis*

Amynthas japonicus is listed as the first extinct Japanese worm (Blakemore, 2019a).
**Michaelsen's publication date seemingly was 1892, presumably before December. Note: Michaelsen (1892: 230) lists *Eisenia fetida* as "*Allolobophora foetida Sav. Fundnotiz: Japan; No. 2121, Hilgendorf rp.*" as this species' first record from Japan also *Aporrectodea trapezoides* as "*Allolobophora trapezoides Dug. .. Japan; No. 2199, Hilgendorf rp.*" plus *Amynthas corticis* as "*Perichaeta indica Horst...*" (see – www.biodiversitylibrary.org/page/6386659#page/238/mode/1up).
***Beddard's "*ausgegeben*" date stated as 30th Dec., 1892, not 1893 as sometimes reported (see – www.biodiversitylibrary.org/page/10195351#page/10/mode/1up) and, because on page 755 he quotes Michaelsen (1892), his publication must defer priority.

However, since Dr Franz Hilgendorf stayed in Japan from 1873 till 1876, introduction of his specimens identified by Dr Wilhelm Michaelsen in 1892 must date to on, or before, 1876 (https://en.wikipedia.org/wiki/Franz_Martin_Hilgendorf). The German zoologist Dr Hilgendorf, taught at the Imperial Medical Academy Tokyo (now Todai 東京大学) from 1873–1876 and probably obtained his specimens there.

Most likely, the species *Eisenia fetida* was first introduced to Tokyo's Botanical Gardens with medicinal plants although there are two gardens in Koshikawa: the Botanical Garden in Hakusan originating as Koishikawa Medicinal Herb Garden established in 1684 by the Tokugawa Shogunate (in 1877, after the Meiji Restoration, the gardens became part of Todai or Tokyo Imperial University/Medical Academy); and the Korakuen Garden constructed earlier in 1629 by Tokugawa Yroifusa the 11th son of Ieyasu that would be a second, less likely, option. Often earthworms are introduced incidentally with soil in potted plants as happened for many exotics, e.g. from Kew Gardens, London (pers. obs. RJB; see Blakemore, 2002, 2008, 2020).

An email sent to Dr Kawakita (kawakita@ns.bg.s.u-tokyo.ac.jp), director of the Gardens on 27th Jan., 2022 for any supporting information has yet to be replied to, but a site resurvey may reveal an interesting as well as historical earthworm fauna.

Nevertheless, this study supports the first record of *E. fetida* in Japan as before 1876.

Table 5. Most critical errors and mistakes in Goto & Hatai's (G & H) Japanese worms, all initially described in currently defunct genus *Perichaeta* Schmarda 1861 now in *Amynthas* Kinberg (*A.*) or *Metaphire* Sims & Easton (*M.*), i.e., no *Pheretima s. stricto.*

#	***Genus***	***species***	**G & H date: page**	**Error statement**	**Actual situation and synonymy**
1	*Metaphire*	*sieboldii* (Horst)	[1898: 65]	Spermathecae in 5/6/7/8	6/7/8/9 — see *M. communissima*
2	*Amynthas*	*fuscatus*	(1898: 66)	Spermathecae in 6-9 or in 5-7	*Amynthas fuscatus*
3	*Amynthas*	*campestris*	(1898: 67)	Spermathecae in 8 & 9 or in 6-8; dorsal pores in 13/14 or 12/13	= *Amynthas robustus* (Perrier, 1872)
4	*Amynthas*	*kamakurensis*	(1898: 68)	One specimen described from "*Kamakura, Tokyo*"!	*Amynthas gracilis* (Kinberg, 1867)?

5	*Amynthas*	*parvulus*	(1898: 68)		*Amynthas gracilis* (Kinberg, 1867)
6	*Amynthas*	*heteropodus*	(1898: 69)	Prostates absent (69) or present in 18 (Tab.)	*Amynthas corticis* (Kinberg, 1867)
7	*Amynthas*	*obscurus*	(1898: 70)	SPs shown as GMs	?
8	*Amynthas*	*scholasticus*	(1898: 70)		*Amynthas corticis* (Kinberg, 1867)
9	*Amynthas*	*decimpapillatus*	(1898: 71)		*Amynthas gracilis* (Kinberg, 1867)?
10	*Amynthas*	*flavescens*	(1898: 72)		*Amynthas gracilis* (Kinberg, 1867)?
11	*Amynthas*	*productus*	(1898: 73)	MP presence or absence confused	*Amynthas gracilis* (Kinberg, 1867)?
12	*Amynthas*	*micronarius*	(1898: 74)	MPs shown with 10 setae between but said to be only 8	*A. micronarius*
13	*Amynthas*	*vittatus*	(1898: 74)	GMs confused with SPs	*A. vittatus* *
14	*Amynthas*	*grossus*	(1898: 75)		= *Amynthas fuscatus*
15	*Amynthas*	*schizoporus*	(1898: 76)	Genital glands confused with spermathecal diverticula	*Amynthas tokioensis* (Beddard, 1892)?
16	*Amynthas*	*takatorii*		Glands as spermathecae	*A. aspergillum* (Perrier, 1872). Taiwan
17	*Amynthas*	*candidus*			Taiwan.
18	*Amynthas*	*irregularis*	(1899: 13)	Setae confused as either 61, or 51 on 17	*Amynthas tokioensis*?
19	*Amynthas*	*iizukai*	(1899: 14)	No caeca	Simple caeca present; = *Amynthas fuscatus*
20	*Amynthas*	*shimaensis*	(1899: 15)		Simple caeca present = ?*Amynthas fuscatus*
21	*Amynthas*	*carnosus*	(1899: 15)	Spermathecae in 5/6/7/8 (i.e. in 6-8) or in 7-9	Spermathecae in 5/6/7/8/9 (i.e., in 6-9); *A. carnosus*
22	*Metaphire*	*acincta*	(1899: 16)	Clitellum absent!	Clitellum present; *M. acincta*
23	*Amynthas*	*agrestis*	(1899: 17)	Goto & Hatai (1899: 23) missed *A. agrestis* manicate caeca	*A. agrestis*
24	*Amynthas*	*parvicystis*	(1899: 18; 23)	SPs & GMs confused; caeca ambiguous	*A. tokioensis* if caeca manicate, otherwise cf. *A. masatakae*

25	*Metaphire*	*glandularis*	(1899: 18)	GMs mid-7 (miscounted); glands near SP & MP	Mid-8 and doubtfully glands near those pores; = *M. hilgendorfi*?
26	*Amynthas*	*levis*	(1899: 20)	Papillae around SPs confused.	*A. tokioensis* (Beddard, 1892)?
27	*Metaphire*	*vesiculata*	(1899: 21)	SPs 6/7/8 – mistaken (as for *P. parvicystis*)?	*M. vesiculata* or possibly synonym of *D. schmardae*
28	*Metaphire*	*megascolidioides*	(1899: 21)	Multiple caeca misdescribed	*M. megascolidioides*
29	*Metaphire*	*communissima*	(1899: 23)	See *M. sieboldii* above	*M. communissima*

SP, MP = spermathecal and male pores, respectively; GMs = genital markings.
**Amynthas vittatus* (Goto & Hatai, 1898: 74) is described in more detail below.

Earlier discovery of their missing types may have prevented chronic taxonomic confusion. Other classical types have possibly been taken and hidden. As Blakemore & Uehara (2011) noted: “*a remark in Easton (1979: 43) that the holotype of his* Polypheretima iizukai *(Goto & Hatai,1899) [=* Amynthas fuscatus *(Goto & Hatai, 1898)] was at one time in the University of Tokyo collection although Dr M. Imajima told him it could no longer be found there*” and Blakemore (2012a) added: “*and this confirmed by Drs. Takenori Sasaki and Rei Ueshima, curators of the University Museum of University of Tokyo (UMUTZ).*” This specimen, at least, is still unfound.

Moreover, around the same time in 2010 another hidden box was found and these vitally important historical samples are now stabilized and stored in Tokyo National Museum (NMST) under curatorial care of Dr Toshiaki Kuramochi with summary data presented in Blakemore (2012a, 2012b, 2016) (Fig. 15, Tab. 6 below).

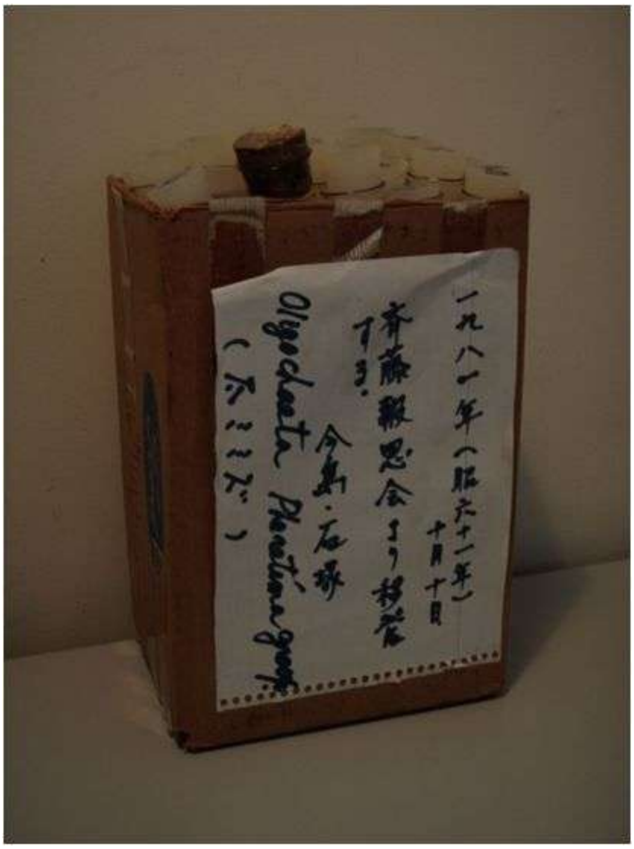

Figure. 15. Another unregistered box of worms – also including Hatai's types! – located in Tokyo National Museum, Tokyo (NMST) by RJB in 2010; label translation: "*1981* (昭和 61)*, October, 10th. Transferred from Saito Ho-on Kai Museum* [in Sendai]*. Imajima & Ishizuka* (石塚小太郎)*. Oligochaeta Pheretima group* (フトミミズ futo mimizu)".

Table 6 has a revised summary of the box contents that were reported on by Blakemore (2012, 2016 - https://veop.files.wordpress.com/2016/08/mmegascolidioides-pdf.pdf).

Table 6. Samples in the Saito Ho-on Kai specimen box found at NMNS Tokyo April, 2010 (see Blakemore, 2012a — www.koreascience.or.kr/article/JAKO201205740752568.pdf; 2012b — www.kahaku.go.jp/research/publication/zoology/download/38_3/BNMNS_A3803_095-124.pdf).

Tube No. #	Identification on original label	Specimen(s) / new NMST No.	Current identification	Specimen status
#1	*Ph. communissima* Goto & Hatai, Sendai-shi 1923-1924	Mature, partly dissected with its guts still in jar/ An428	*Metaphire communissima* (Goto & Hatai)	Specimen [Note: many other specimens in NMST].
#2	*Ph. glandularis* Sendai-shi 1923-1925	Mature/ An427	*Metaphire glandularis* (Goto & Hatai, 1899)	Specimen, synonym of *M. hildgendorfi*?
#3	***Ph. acincta*** Goto & Hatai /VIII 1930	Mature, dissected with part of gut missing/ An429	*Metaphire acincta* (Goto & Hatai, 1899)	**Neotype**
#4	*Ph. schmardae* Horst Nagasaki-shi	Mature/ An430	*Metaphire californica*	Misidentified specimen

			(Kinberg, 1867)	
#5	***Ph agrestis*** Goto & Hatai Morioka [Iwate-ken, Tohoku]	Two matures/ An431, An432	*Amynthas agrestis* (Goto & Hatai, 1898)	**Neotype** (cf. #17 & Mishima specimens coll. by RJB)
#6	*Ph. hilgendorfi* Michaelsen Sendai-shi 1923-1925	Mature/ An434	*M. hilgendorfi* (Michaelsen, 1892)	Specimen
#7	***Ph. carnosa*** (Goto & Hatai) Sendai-shi 1923-1925	Mature/ An435	*Amynthas carnosus* (Goto & Hatai)	**Neotype.** (Blakemore, 2012a)
#8	*Ph. sieboldi* Horst Kochi 17/X 1930	Aclitellate sub-adult/ An436	*M. sieboldi*	Specimen
#9	***Ph. yunoshimaensis*** (sic) Hatai Yunoshima Aomori-ken 1922	Mature (undissected)/ An437	*Amynthas*? *yunoshimensis* (Hatai, 1930)	**Topotypic neotype** (?syntype); syn. of *M. hilgendorfi*)
#10	*Ph. irregularis* Goto & Hatai Location	Mature/ An438	*Amynthas irregularis* (Goto & Hatai)	Syn. of *A. tokioensis*? [Cf. #11 & #16]
#11	*Ph. levis* Goto & Hatai Sendai Location 5/X 1930	Mature/ An439	Nothing of note differs from *A. irregularis* #10	Specimen cf. #10 & #16
#12	***Ph. phaselus*** Hatai Location Aomori 1922	Mature, undissected/ An441	Appears same as *A. maculosus* #13	**Syntype?** (syn. *A. maculosus*?) [See #13]
#13	***Ph. maculosus*** (Hatai) Aomori Yunoshima 1927	Mature, undissected/ An442	*A. maculosus* (Hatai, 1930)	**Syntype** (syn. of *A. phaselus*?) [See #12]
#14	*Ph. Marenzelli* Cognette (sic) 24/XI 1929 Aone Onsen Miyagi-ken	2 matures/ An443 (both specimens)	*Amynthas marenzelli* (Cognetti, 1906)	Specimens (syn. of *A. corticis*)
#15	***Ph. vittata*** Goto & Hatai, Kanagawa, Odawara-eki /VIII 1930	Mature/ An444	*Amynthas vittatus* (Goto & Hatai, 1898)	**Neotype** (not syntype as collected >1898)*
#16	*Ph. abnormal* Location	Mature/ An440	Nothing of note differs from *A. irregularis* #10	Specimen cf. #10 & #11
#17	*Ph. agrestis* Goto & Hatai	Mature/ An423	*A. agrestis*	See #5 also
#18	*Ph. sp.* 16/VI 1931	Mature/ An445	*A. micronarius* (Goto & Hatai)	Specimen (cf. #19)
#19	***Ph. micronaria*** Goto & Hatai [no other info.]	2 matures, both undissected/ An446 and An423	*A. micronarius* (Goto & Hatai)	**Neotype** (cf. #18) (Blakemore, 2012b)
#20	***Ph. yamadai*** Hatai Collected from Tottori type-locality	Mature, undissected/ An447	*Amynthas yamadai* (Hatai, 1930)	**Neotype** (Blakemore, 2012a)

*_Amynthas vittatus_ is described in more detail below.

DNA sampling was attempted on these historical specimens (with many failures), but no funding was made available for completion of taxonomic analyses. Nevertheless, an update is provided below based upon *A. vittatus* Neotype (Fig. 16).

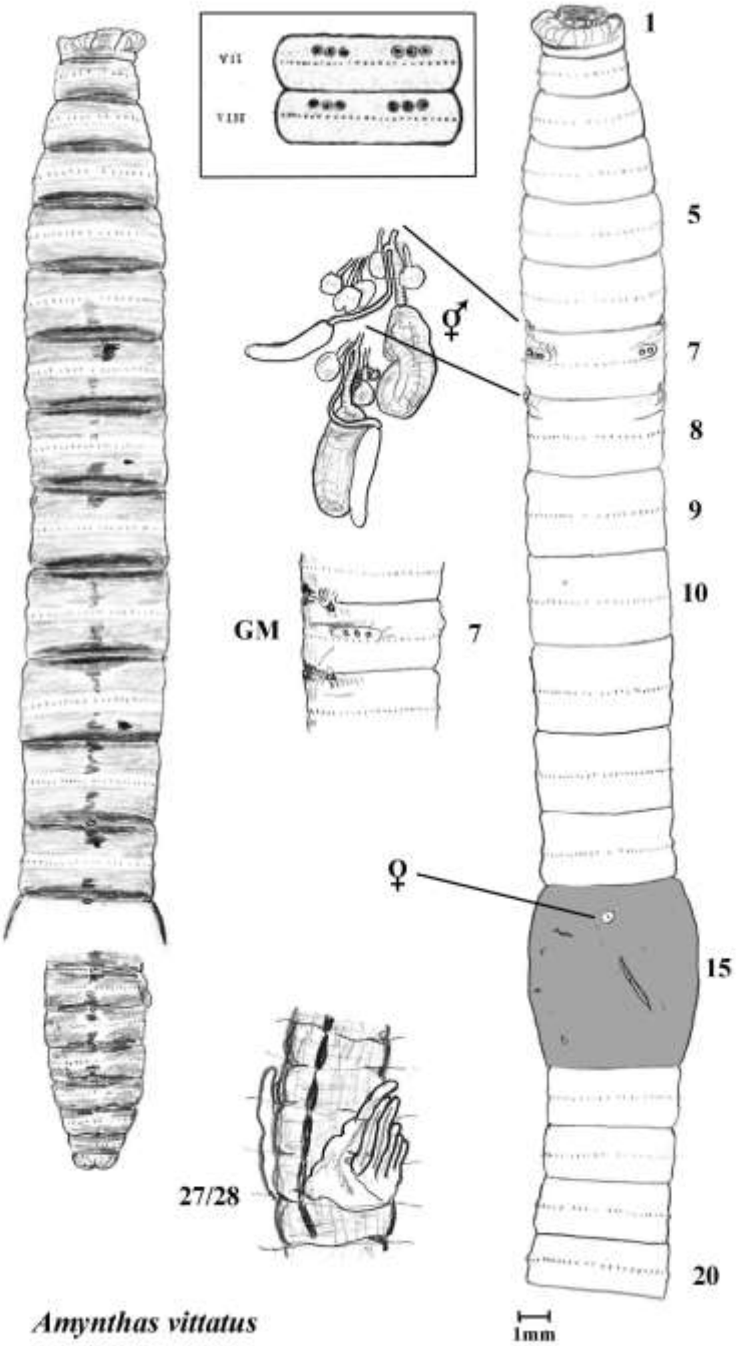

Figure 16. *A. vittatus* Neotype (NMSTAn444a) from "*Odawara-eki*" after Blakemore (2012b: fig. 14). Author's copy of this figure deposited in Odawara Museum Library.

>JET083-10 [organism=Amynthas vittatus] [NMSTAn444a Neotype] COI partial (Ns are added by Sanger sequencer for unresolved nucleotides these omitted by Genbank).
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN

NNNNNNNNNCCAAATTTATAATACTATTGTAACAGCACATGCTTTCGTAATAAT
TTTTTTCATGGTAATACCTATTATAATTGGTGGATTTGGTAATTGATTAGTTCCA
CTAATATTAGGAGCCCCTGATATANNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
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BLAST: Lepidoptera sp. BOLD:AAF1106 = 116/123 (94%), i.e., likely contamination.
JET083 vs GenBank KX400713 *A. vittatus* from Hokkaido: 77%, i.e., no relationship.

KX400713 vs. AB542566 *A. vittatus* from Hokkaido: 100%, i.e., same taxon.
KX400713 vs. AB542571 *A. vittatus* from Hachioji, Tokyo: 99.69%, i.e., same taxon.
KX400713 vs. AB474322 *"Amynthas vittatus*" Sendai: no similarity, i.e., misidentity.

>JET166-11|An-444|Amynthas vittatus| COI retry – nil result. It is anticipated that more refined DNA techniques in the future will allow sequencing from such older types. A useful project would be to resample topotyic specimens from Odawara.

Distribution of *A. vittatus*: Original type-localities were all within the Kanto Plain but designation of the Neotype now restricts this to Odawara. In Japan it occurs from Hokkaido to Kyushu also from Oshima and Kagoshima. It is distributed on Kunashiri Islands (Russian Federation), but from molecular phylogenetic analysis (mtDNA COI) is thought to be relatively recent invader (Shekhovtsov *et al.*, 2018), and also from South Korea. An unverified report as "*Metaphire levis*" from Ashford, northeastern Connecticut was noted in Blakemore (2010b). Revisiting this, Blakemore (2012b) said: "*Characteristics merge between Goto and Hatai's schizoporus and levis; in all cases male pores were absent or superficial, i.e., not proven to qualify for Metaphire. Thus all three taxa (irregularis, schizoporus and levis) are potentially synonymous with A. vittatus. But since banding is distinctive (less marked in Korean worms according to Kobayashi, 1938) only for A. vittatus (and A. levis?), these other names are more likely associated with A. tokioensis*". On viewing Schneider & McDevit (2002: fig. 1A) of "*Metaphire levis*" [as identified by "*Dr. John W. Reynolds of the Oligochaetology Laboratory, Kitchener, Ontario*"] it lacks distinctive banding so seems most likely referable to *Amynthas tokioensis*. Moreover, *A. vittatus* tends to a larger size <220 mm, while *A. tokioensis* is generally <150 mm as also pertains to their photographed specimen.

Thus this Odawara earthworm, *Amynthas vittatus* (Goto & Hatai, 1898), is not proven to occur in USA and its tentative report from there should be scratched in favour of *A. tokioensis* (Beddard,1892) that already has many USA records (Fig. 17).

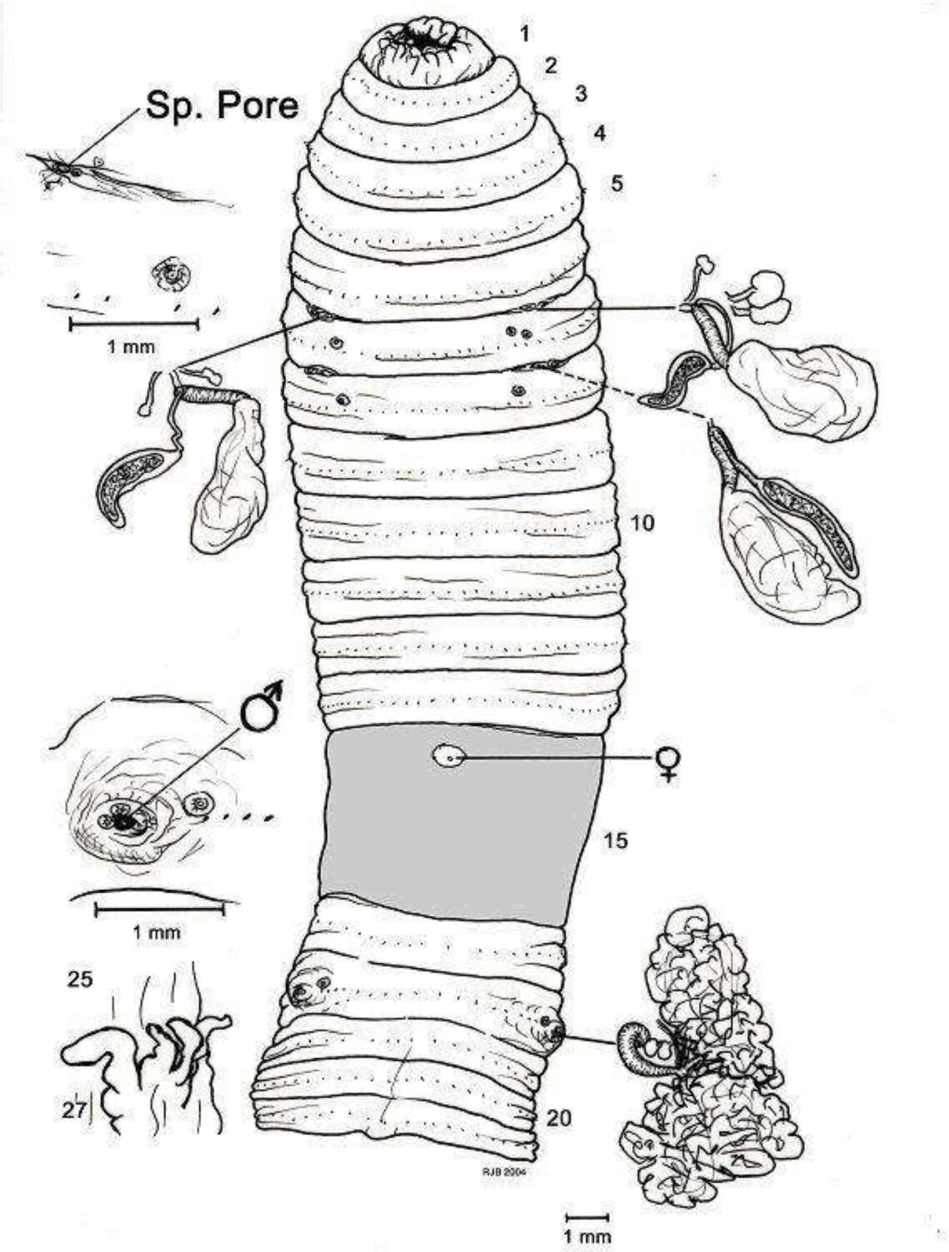

Figure 17. Author's 2004 sketch of *Amynthas tokioensis* (Beddard, 1892) lectotype in British Museum: BMNH:1904.10.5.166 (after Blakemore 2008: fig. 5.1 - www.annelida.net/earthworm/Japanese%20Earthworms/Japanese%20Earthworms.pdf; 2010: fig. 2 - www.researchgate.net/profile/Robert-Blakemore/publication/271751944_Saga_of_Herr_Hilgendorf's_worms/links/590b3810aca272f6580eb221/Saga-of-Herr-Hilgendorfs-worms.pdf ; Blakemore 2020: fig. 2.2.2).

mtDNA COI barcode available online, e.g. Genbank KY750706 *Amynthas tokioensis*. BLASTn: 99.85% KY750705 *A. tokioensis* from Hokkaido; 99.69% *A. tokioensis* from Sendai; 99.53% "*Metaphire hilgendorfi*" from Aomori, i.e., a misidentification!

BLASTn: KY750706 *A. tokioensis* vs. KX400713 *A. vittatus* = 90.27%, i.e., ~10% difference indicates taxa separate at specific level. Q.E.D.

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